Trig Final (Solution v31)
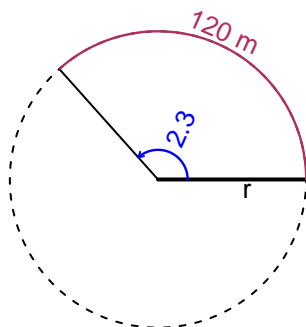
- You should have a calculator (like Desmos) and a unit-circle reference sheet.

Question 1

In the figure below, we see a circle and a central angle that subtends an arc. The angle measure is 2.3 radians. The arc length is 120 meters. How long is the radius in meters?
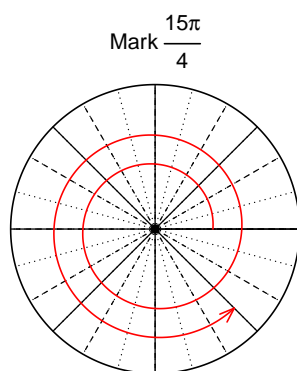

$$\theta = \frac{L}{r} \qquad r = \frac{L}{\theta} \qquad L = r\theta$$
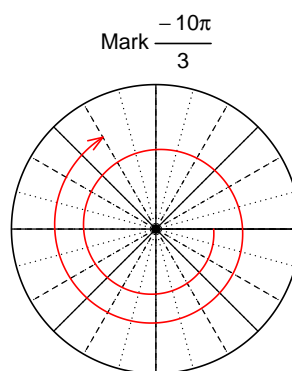
$r = 52.17$ meters.

Question 2

Consider angles $\frac{15\pi}{4}$ and $\frac{-10\pi}{3}$. For each angle, use a spiral with an arrow head to **mark** the angle on a circle below in standard position. Then, find **exact** expressions for $\cos\left(\frac{15\pi}{4}\right)$ and $\sin\left(\frac{-10\pi}{3}\right)$ by using a unit circle (provided separately).

Mark $\dfrac{15\pi}{4}$

Mark $\dfrac{-10\pi}{3}$

Find $\cos(15\pi/4)$

Find $\sin(-10\pi/3)$

$\cos(15\pi/4) = \frac{\sqrt{2}}{2}$
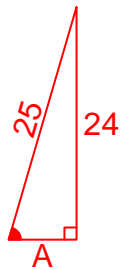
$\sin(-10\pi/3) = \frac{\sqrt{3}}{2}$

Question 3

If $\sin(\theta) = \frac{-24}{25}$, and θ is in quadrant III, determine an exact value for $\tan(\theta)$.
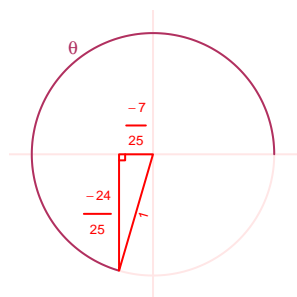
Ignore any negatives and the quadrant, and draw a right triangle (based on SOHCAHTOA) in standard (quadrant I) orientation.

Solve the Pythagorean Equation

$$A^2 + 24^2 = 25^2$$
$$A = \sqrt{25^2 - 24^2}$$
$$A = 7$$

Rescale the triangle so the hypotenuse is 1. Reflect the triangle into Quadrant III in a unit circle.

$$\tan(\theta) = \frac{\frac{-24}{25}}{\frac{-7}{25}} = \frac{24}{7}$$

Question 4

A mass-spring system oscillates vertically with an amplitude of 2.05 meters, a midline at $y = -7.75$ meters, and a frequency of 5.99 Hz. At $t = 0$, the mass is at the maximum height. Write an equation to model the height (y in meters) as a function of time (t in seconds).

Any of these equations would get full credit.

$$y = 2.05\cos(2\pi 5.99t) - 7.75$$

or

$$y = 2.05\cos(11.98\pi t) - 7.75$$

or

$$y = 2.05\cos(37.64t) - 7.75$$